DISCOVERY OF X-RAY EMISSIONS FROM JUPITER

Observations made with the focusing X-ray telescope on the High-Energy Astrophysical Observatory HEAO 2 have resulted in the discovery of X-ray emission from Jupiter. The findings are expected to add to our knowledge concerning the belts of trapped, energetic, charged-particle radiation that surround the planet, and could provide new information on the surface composition of Jupiter's large moons. Analysis of the results is being conducted by JPL in collaboration with scientists at the Massachusetts Institute of Technology, Smithsonian Astrophysical Observatory, the Danish Space Research Institute, and the French Center for the Study of Space Radiation.

A search to detect X-rays produced within Jupiter's magnetic field began several years after the detection of radio wave emission, based on an analogy of terrestrial aurorae that are accompanied by X-ray emission. Since the Earth's atmosphere is opaque to X-rays, experiments have been carried out on balloons, rockets, and satellites. During this search the measured upper limits of emission have been reduced by several orders of magnitude. In recent years there has been a study at JPL to calculate the X-ray emission from the Galilean satellites resulting from their bombardment by the energetic particles in Jupiter's radiation belt. The observed X-rays fall in the 0.2 to 3-keV range. The preliminary analysis indicates that most, if not all, of the observed X-rays are coming from the proximity of Jupiter itself.

The recent observation of Jovian aurora made by the ultraviolet experiment on the Voyager 1 and 2 spacecraft suggests a common origin for the X-rays. The UV and X-ray emission may be products of a similar mechanism -- from free electrons interacting with particles in the atmosphere of Jupiter.

The X-ray observations provide a new method of studying the characteristics of the Jovian magnetosphere to improve our understanding of the mechanisms by which energy is provided to Jupiter's magnetic field, transferred to the radiation flux within it, and subsequently dissipated. Because the measurements can be made by an Earth satellite, they can be made over long periods of time.

A comparison of these observations, with relevant measurements made by the UV spectrometer, particle flux detector, and radio astronomy instrument on the two Voyagers, is expected to assist in their interpretation as well as in planning future X-ray observations of Saturn and Uranus.

Figure (opposite page): One of the three observations of X-ray emission from Jupiter made by the Einstein (HEAO 2) Observatory in 1979 using an Image Proportional Counter positioned at the focus of the X-ray telescope.

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